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Further Observations on the Milk Supply of Washington, D. C.

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FURTHER OBSERVATIONS ON THE MILK SUPPLY OF WASHINGTON, D. C.*

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At the meeting of the American Medical Association held in June, 1907, I had the honor of taking part in the symposium on milk, held in this Section. At that time I submitted some observations on the origin and progress of the movement for the betterment of the milk supply at the national capital. Attention was called to statements made in the "Report on Typhoid Fever in the District of Columbia," [1] submitted by the medical society of the city to the House Committee on the District in 1894, and to the report of the Washington Milk Conference. This report was issued subsequently, Aug. 20, 1907, by the Department of Agriculture.[2]

Consideration of this subject is again desirable from the facts that national, state and municipal authorities have not yet fully realized the gravity of the situation; that many physicians still appear to be either ignorant or indifferent to the dangers, and that only recently at Washington, the National Association for the Study and the Prevention of Tuberculosis, in a series of resolutions regarding the pasteurization of milk showed itself loath to admit positively conclusive evidence of the communicability of bovine tuberculosis to man.

HISTORY OF EFFORTS FOR PURE MILK

Much interest was manifested in the presentations, which I made and great satisfaction was expressed

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* Read in the Section on Preventive Medicine and Public Health of the American Medical Association, at the Sixty-first Annual Session, held at St. Louis, June, 1910.

1. Report on Typhoid Fever in the District of Columbia, submitted by the Med. Soc. of the D. C. to the Committee on the District of Columbia of the U. S. House of Representatives, June 14, 1894.

2. Sanitary Milk Production. Circ. 114 Bur. Animal Industry. Dept. Agric.

that the officials and the scientific experts of the United States government had so actively joined in this movement for the improvement of the public health. I was so impressed with this reception of the work of the Washington Milk Conference that immediately on my return to Washington I sought an interview with Mr. Roosevelt, then President of the United States. At this interview I submitted the following letter:

In view of the agitation that is now going on in Europe and this country with reference to the question of the influence of milk on infant mortality, as well as the causation of tuberculosis, typhoid and scarlet fevers, and diphtheria, I would respectfully suggest that you direct the Bureau of Public Health and Marine-Hospital Service to make a thorough investigation of the milk industry in the District of Columbia from the farm to the consumer. For this purpose the Bureau should be empowered to have the cooperation of other departments of the government, and proper credit should be given for such aid.

Several foreign governments have recently ordered such investigations, and the reports are frequently quoted by writers in the United States on these subjects. These writers have expressed many divergent views.

The recent investigation conducted by the Bureau of Public Health and Marine-Hospital Service into the cause of the prevalence of typhoid fever in the District of Columbia, which report, including an examination of the milk-supply in the City of Washington, has been printed and will be issued in a few days, and the work of the Department of Agriculture concerning the milk-supply at the farms, have shown that many lives could have been saved and numerous cases of disease avoided by more careful attention to the health of the dairyman, as well as of the cows, and the handling of the milk at the farm, in transportation, and distribution in the city.

Much valuable information has been accumulated by both departments, which can be consolidated and developed so as to be utilized as a standard not only for the District of Columbia, but for the United States. This standard is very essential at the present time, and, with the facilities at the disposal of the United States government, should have equal weight with that of any other government.

It can be readily shown that much can be done to improve the milk-supply without materially adding to the cost of the farmer and thus to the consumer.

The report of such an investigation should be freely illustrated that it may serve as an educational document.

President Roosevelt had previously shown great interest in public health matters. He grasped the importance of the subject and immediately directed an investigation,

which was conducted by recognized experts in the United States Department of Agriculture, the United States Public Health and Marine-Hospital Service of the Treasury Department, and Dr. W. C. Woodward, health officer of the District of Columbia.

These experts elaborated and endorsed in every particular the work of the Washington Milk Conference. Their report under the title of "Milk and its Relation to the Public Health," was issued in January, 1908, by the United States Treasury Department.[3] A revised edition was issued January, 1910, as Bulletin 56. While this publication is one of the most valuable ever issued by the government on public health, its value would have been greatly enhanced had it been submitted to a conference of writers of the various articles and the advisory board of the Bureau of Public Health and Marine-Hospital Service. Then probably the statements would have been in greater harmony and the endorsement of such a distinguished body would have added greatly to its authority.

The movement for the improvement of the milk-supply in Washington seems to have two distinct periods, one from 1894 to 1907, the other from 1907 to date. It will be desirable to recall some of the incidents connected with this movement and the results that have accrued. The progress of the first thirteen years was great; that of the last three years has been marvellous. The work done in Washington has exerted an influence not only in this country but also in Europe. In fact, its influence has also extended to Australia.

At a public meeting on Feb. 5, 1894, called for the purpose of aiding in the improvement of the sanitary condition of the city of Washington, the late Dr. Charles Smart of the army read a paper on "The Causes and Prevalence of Typhoid Fever."

The statements made by Dr. Smart were so startling and of such damaging character to the prosperity of the city that I called the attention of the Medical Society of the District of Columbia to them at the meeting held on February 7 and moved for the appointment of a committee to consider the subject. Dr. W. W. Johnston, Dr. C. M. Hammett and myself were appointed as such committee.

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3. Bull. 41 Hyg. Lab. U. S. P. H. and M.-H. S.

It was found that the conditions were even worse than Dr. Smart had represented. The committee considered that there were four principal causes for the occurrence of the disease: (a) Potomac water-supply; (b) pollution of the soil by the leakage from privies, defective sewers and the backing up of sewage from tidal movements; (c) to drinking of well or pump water; (d) drinking of contaminated milk.

Among the recommendations of the committee, which were unanimously adopted by the medical society, were the construction of works for the filtration of the Potomac or Washington water—the only method of purification—the abandonment as rapidly as possible of all wells within the city limits; the repairing of defective sewers; the extension of the water supply and the sewers; the making of house connections to these.

The views of the committee as to the unhealthfulness of well waters were fortified by the results of bacteriologic examinations of water from thirteen wells in the city of Washington, made by Dr. J. J. Kinyoun. The water from nine of these wells was classed as bad, and from two as suspicious. It was recommended that the nine wells be closed and that the remaining four be kept under observation.

The influence of these two recommendations in the committee's report was immediately noticed:

> 9. Careful inspection of all dairies in the District from which our milk-supply is drawn, and the enactment of a law by which no milk shall be sold in the District without a permit from the health office. The inspection should cover an examination at the dairies of all possible sources of infection, including the water-supply.
>
> 10. The urging on the members of the profession of a careful collation of all facts bearing on the mode of infection in each case, and the advantage of reporting such facts to the society, and the propagation of the doctrine that immediate disinfection of the stools is the first duty of the physician as guardian of the health of the community.

It will be seen that pure milk and pure water, both in the city and at the farm, and the avoidance of contact with persons suffering with the disease, were the cardinal preventive measures recommended. The importance of these recommendations was immediately recognized. The United States Congress, as well as the city authorities, sought the aid of the medical society and individual members in framing remedial legislation.

That the recommendations made in 1894 were important and proper is attested by remarks made at the symposium on the causes of typhoid fever in the District of Columbia, held, on my motion, by the medical society, Feb. 19 and 26, 1908. Dr. George M. Kober, professor of hygiene, Georgetown University, said that "every point developed in recent discussions, save the influence of domestic filters and water-coolers, had received consideration before." Dr. Kober's investigation in 1895 confirmed in every particular the conclusion reached by the committee of the medical society in 1894, and developed two new facts, viz., the percentage of imported cases and the agency of flies in the transmission of the disease. Dr. William C. Woodward, health officer of the District of Columbia, said that the problem "Why is typhoid fever more prevalent in the District of Columbia than in other communities?" was clearly the problem before the medical society in 1894, when it inaugurated the campaign against the disease, and the clear realization of the problem to be solved contributed very largely, no doubt, to making the work of that committee as thorough and the results as complete as they were." It may safely be said that, aside from the one or two new facts brought to light by Dr. Kober's investigations, to which Dr. Kober has referred, no material fact has been disclosed by any subsequent investigation that was not anticipated in the report of the medical society.

The contention for pure water, pure milk, and the avoidance of contact, outlined in 1894, as preventive measures against typhoid fever is further sustained in Bull. 44 of the United States Public Health and Marine-Hospital Service,[4] as follows:

> Thus far our studies indicate that typhoid fever will cease to be a problem in any community having clean water, an uninfected milk supply, and in which cases of the disease are treated as dangerous and contagious.
>
> In drawing up the conclusions and recommendations of this report we have had the benefit of consultation with the advisory board of the hygienic laboratory, composed of eminent scientists and sanitarians. This privilege is appreciated and we desire to acknowledge the help we have received from the members of the board collectively and individually.

The first step toward carrying out the recommendation of the committee of 1894 was the passage of an

4. Bull. 44 Hyg. Lab. U. S. P. H. and M.-H. S., May, 1908, p. 9.

act by Congress, approved March 2, 1895, which required the inspection of all dairy farms and a permit from the health officer of the District of Columbia before milk could be sold for consumption in the city of Washington. This requirement applied not only to the farms in the District of Columbia, but also to those in the states supplying milk to Washington.

CARD REGISTRATION OF DAIRIES

About this time Dr. W. C. Woodward was appointed health officer. He instituted the registration of the results of the inspection of the farms and depots on cards known as score-cards. Washington has the honor of being the first city in the country, if not in the world, to require inspection of the dairy farms as well as the milk depots in the city.

The use of score-cards has proved to be very popular as well as valuable. Many states and cities have adopted them. The United States Department of Agriculture reports that it has supplied them to about 300 cities in thirty-nine states, and that they are being widely used. The province of Ontario, Canada, has also adopted inspectors and the score-card system of recording such inspection. Previous to January, 1908, less than 50 cities had sought the cooperation of the Department of Agriculture in instituting inspection. These figures, however, do not represent the full extent of the use of the score-card system as it has been formally adopted by the state health authorities of fifteen states, and is being introduced by them in the cities under their supervision.

This inspection has revealed many unfavorable conditions both at the farm and at the city depot. Insanitary houses, milk houses and barns were common. The attendants on the cattle were careless of their personal habits and frequently were suffering from disease, sometimes of a contagious character. Cattle were frequently found covered about their flanks, legs, udders, and tails with manure and other dirt, which readily dropped into the pails while milking was being done. Cattle were many times found suffering from constitutional diseases as well as local affections of the udder. Flies swarmed about the premises. Frequently on the surface of the milk in the pails floated dead and dying flies. With the knowledge now available of the habits

of the fly, this condition alone is a most dangerous source of milk infection. Dr. L. O. Howard in a recent publication by the Department of Agriculture suggests that the common house fly be known as the "typhoid fly." The presence of sediment in the milk containers was a common occurrence. This is especially dangerous, since it has been shown that the ingredients are pus cells, blood, epithelium, barn-yard manure, and varied bacteria, including colon bacilli, and, as shown by Schroeder and Cotton, very commonly the tubercle bacillus.[5]

Few, if any, facilities were found for boiling the water to cleanse the utensils used in the handling and transportation of milk, the hands of the milkers, or the udders of the cows. Polluted water readily contaminates milk. This contamination rapidly multiples at a temperature above 50 F. The knowledge which is rapidly being accumulated as to chronic carriers of the typhoid bacillus, and the common custom which prevails in rural communities of depositing human excreta on the ground, frequently in close proximity to residences, barns, and water-supplies, demand that the water-supply on dairy farms should be frequently examined and carefully guarded against contamination. The location of the premises for the storage and the handling of dairy products in the city depots was frequently most objectionable and at times entirely unfit for such purposes.

The following are some results of one year's use of the score-card system of inspection at Indianapolis:

Dairies scored, 717.
Barns improved, 381.
New barns built, 41.
Milk rooms built or repaired, 319.
Visits made by request to advise about constructing new barns or repairing old ones, 137.

The report of the official in charge says:

While at first we met with serious opposition, producer and dealer have become convinced that instead of persecution, the work is for their betterment.

Numbers have thanked us for insisting that they improve their conditions, stating that they do not see how they could have produced milk under the conditions they did.

5. See Bull. 99 and Circ. 118, Bureau Animal Industry, Dept. of Agric.

The records of inspection as kept on score-cards show the result of intelligent inspection of the dairy farms supplying milk to Richmond from May, 1907, to May, 1908. The first inspection in May gave an average of 41.5 out of a possible 100; the inspection in April of the following year, twelve months later, gave an average of 72 for the same premises. This demonstrates a gain of nearly 100 per cent. for the year. The improvement was steady throughout this time.

In the annual report of the Richmond, Va., health department for 1908 the dairy inspector in his report to the chief health officer says: "The disposition among our dairymen to improve their plants is wonderful, and all speak highly of the work of the health department."

Washington city also furnishes an excellent illustration of the effects of intelligent inspection. The inspectors and the producer have learned to understand each other. Many of the farmers welcomed the criticisms and proceeded to remedy these defects, as it was found that much could be done at an insignificant outlay of time and money. Much higher scores were given in many cases on the second inspection. As a result of this educational inspection much milk is delivered to the distributing depots with less than 2,000 bacteria to the cubic centimeter.

At the meeting held Sept. 22, 1909, in Washington, of the Milk Producers' Association of Maryland, Virginia, and the District of Columbia, President Thomas in his address reminded the members of the association that the day was past when the milk inspector was "looked on as an irreconcilable enemy."

Such expressions show the spirit with which intelligent inspection is met. This educational inspection means much to both producer and customer. It contributes not only to the health of the families of both, but also to that of the dairy herd. It is a well-known fact that typhoid fever prevails to an alarming extent in rural communities. It has been found that it is two and a half times more prevalent in the counties of Maryland than in the city of Baltimore. Tuberculosis is also quite common in the country.

RESULTS OF INSPECTION

Inspection has worked well; it should be perfected and extended. It should be assumed by state and mu-

nicipal authorities and not left to the enthusiasm of public-spirited physicians and other citizens. Washington has apparently had most satisfactory results from the requirements for inspection. Dr. W. C. Woodward, health officer of the city of Washington, D. C.,[6] says:

> The death-rate from diarrheal diseases among infants during the five-year period 1880 to 1884 was 162 per 100,000. During the next five-year period it was 168, and from 1890 to 1894 it was 175. In 1895 the milk law was enacted. From 1895 to 1899 the death-rate fell to 135; from 1900 to 1904 it fell to 109, and in 1905 it was only 104, and in 1906, 1907, and 1908 only 97 per 100,000.

In 1909 it fell to 72. It is gratifying to see that 405 fewer babies died in 1909 than in 1894, the year before the milk law was passed.

The diagram that accompanies Dr. Woodward's article (Chart 1) shows the above facts graphically.

MILK AND WATER AS AGENCIES

The improvement in the death-rate from diarrheal diseases, typhoid, malarial and typhomalarial fevers has also been very marked in the period since the enactment of legislation governing the milk supply, and especially so since the active movement for its improvement started in 1907. The title "typhomalarial fever" is no longer used in the classification of diseases. It is a question if the many deaths attributed to malarial fever should not be considered as typhoid. The data of the one are similar to those of the other. Chart 2 well illustrates these observations. The rate 33.2 from typhoid fever in 1909 encourages the hope that Washington with continued improvement in its milk-supply will soon attain a much lower death-rate.

The rate in 1909 would have been lowered had the hospitals had a more nearly normal death-rate. There seems to be a connection between the death-rate and the milk-supply of the hospitals. In 1909 there were 780 cases of the typhoid reported with 114 deaths; 70 of these deaths occurred in hospitals. With the normal death rate of 10 per cent. 36 lives should have been saved.

With the limit of safety of "inspected" raw milk fixed at 100,000 the following numbers of bacteria per c.c.

6. Bull. 41 Hyg. Lab. U. S. P. H. and M.-H. S.

were found in milk furnished to Washington hospitals: 2,000,000; 2,800,000; 3,500,000; 4,000,000; 5,000,000; 10,000,000; 10,000,000; 15,000,000; 50,000,000; 111,000,000.[7]

The mortality from typhoid in some Washington hospitals reached the appalling rates of 25, 20, 18 and 16 per cent., although a few have the normal death-rate of 10 per cent. But in only one instance was the German

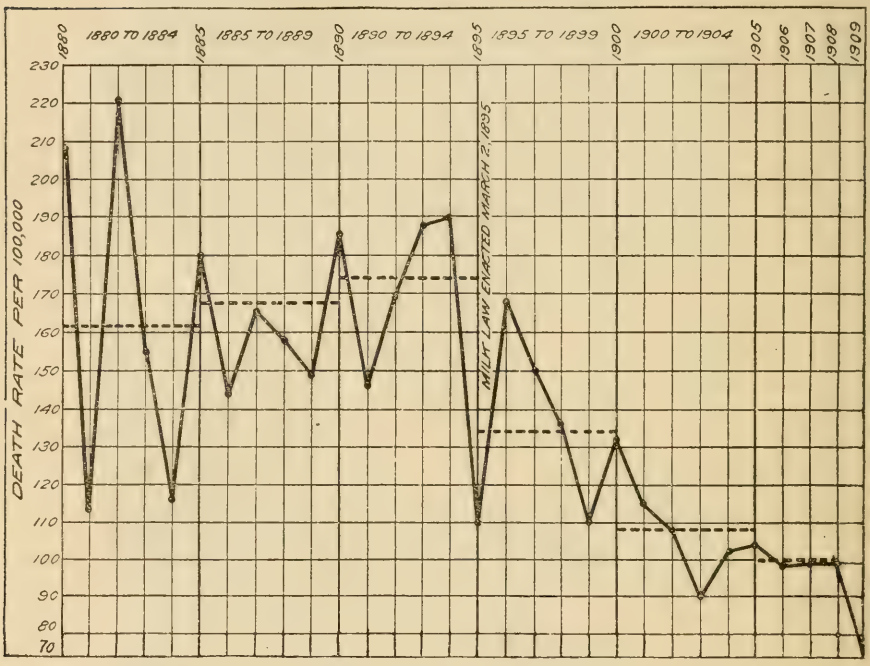

Chart 1.—Diagram showing decreasing death-rate of children under two years of age from diarrheal diseases in the District of Columbia following the enactment of the milk law of 1895. Dotted lines show averages. (In 1909 the death-rate fell to 72.)

mortality rate of 5 per cent. approached, and this was as low as 7 per cent.

It will be noticed that the highest record was reached in 1890. Two factors can be considered as causing this. Kober has attributed it to unusual contamination of the Potomac water supply by the sewage from Cumberland, Md., where an epidemic of typhoid fever prevailed in the winter of 1889-1890. I attribute it to the

7. See Bull. 41 Hyg. Lab. U. S. P. H. and M.-H. S., p. 431, et seq.

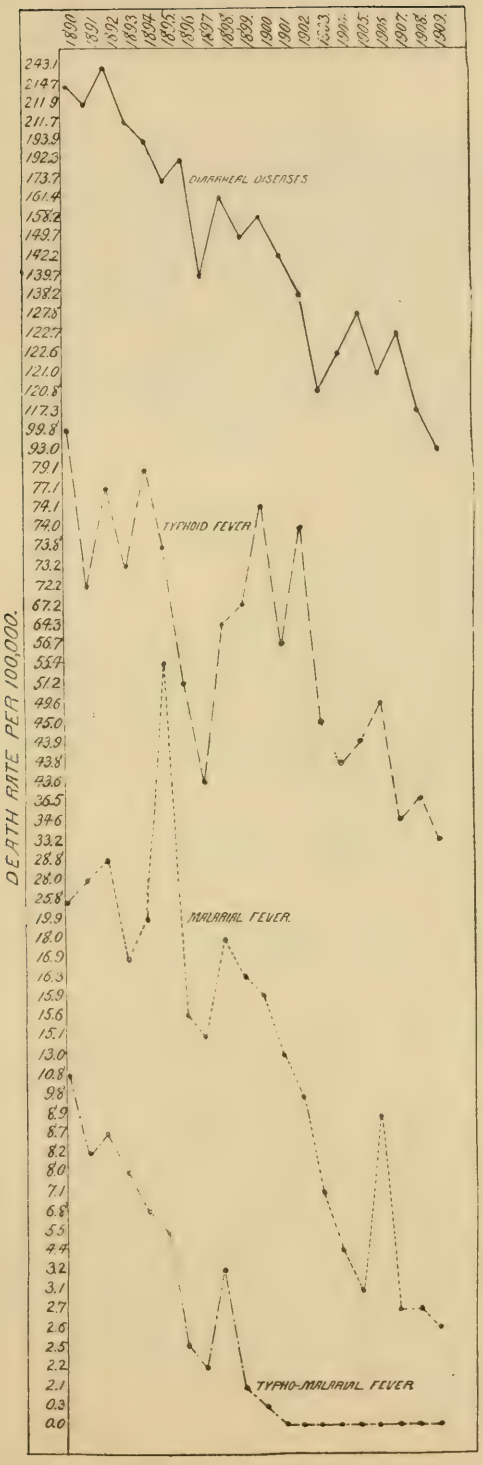

Chart 2.—Diagram illustrating death-rate per 100,000 of population for diarrheal diseases, typhoid fever, malarial fever and typho-malarial fever, during the period 1890 to 1909 inclusive.

greater contamination of the milk-supply. This was brought about by the abnormally high temperature that prevailed during the winter. The Weather Bureau reports it as having been the warmest winter for fifty years. No ice was gathered. Consequently milk was almost constantly exposed to a temperature conducive to the growth of bacteria. It is well known that colon and typhoid bacilli proliferate rapidly as soon as the temperature goes above 50 F. May this not help to explain the increased prevalence of typhoid in winter in localities where the temperature goes repeatedly above 50 F.?

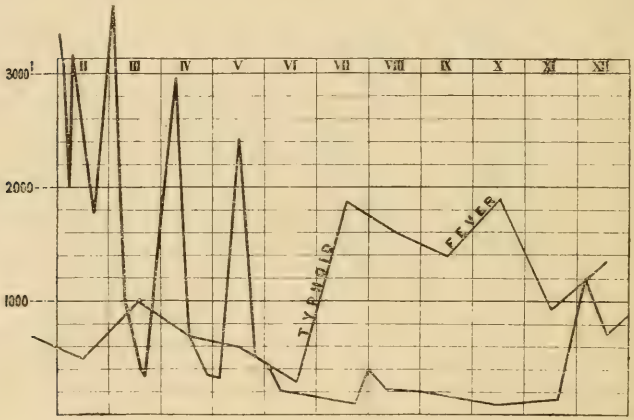

Chart 3.—Diagram prepared by Dr. Theobald Smith, showing comparative number of bacteria found in 1 c.c. of Potomac water in 1886, and also death-rate of typhoid fever during same year.

The winter of 1889-1890, as stated, was the warmest for fifty years. The winter of 1908-1909 was unusually warm. The winter 1909-1910 was quite cold. From January to May, inclusive, in 1909 (warm winter) there were 236 cases of typhoid reported, while during the same period of 1910 (cold winter) there were only 126 cases reported.

Comparison of the diagram with the one prepared by Dr. Theobald Smith (Chart 3) on the seasonal prevalence of typhoid fever practically eliminates the Potomac water as a serious causative agent. The filtration plant now positively eliminates it, as is shown by the accompanying table. There is no need to resort to the boiling of Potomac water.

Contrary to every expectation, there was no diminution in the prevalence of typhoid fever following the completion of the filtration plant in the fall of 1905 as compared with the few preceding years. Numerous investigations were undertaken and reports made; some covered conditions in the city, and others covered both the city and the dairy farms.

RESULTS OF TEST FOR BACILLUS COLI OF 10 AND 1 C.C. SAMPLES FROM FILTERED WATER, RESERVOIR AND TAP WATER FROM VARIOUS PARTS OF THE CITY

Fiscal year.	Number samples examined.	Samples in which *B. coli* was positively determined.	
		Number.	Percentage.
1905-6	502	8	1.60
1906-7	1,630	52	3.18
1907-8	2,232	42	1.88
1908-9	2,294	15	0.67
1909-10*	940	0	0.00

* Five months only, July to November, 1909, inclusive.

The Bureau of Public Health and Marine-Hospital Service issued three special bulletins on "The Origin and Prevalence of Thyphoid Fever in the District of Columbia." [8] From the peculiar limitations of the functions of this bureau the investigations were mainly of the conditions existing in the District—not in the outlying states.

Continued study convinced me that stricter attention must be paid to the conditions at the dairy farms, including their water-supply, to which I had called attention in 1894. I submitted these views to the Hon. James Wilson, Secretary of Agriculture, at an interview in September, 1906.

Under the direction of the Secretary of Agriculture, every one of the approximately 1,000 farms supplying milk to Washington was inspected by the Bureau of Animal Industry in the fall and winter of 1906-7. The average score of these farms was as low as 45.03 out of a possible 100. On 60 farms, taken at random, bacteriologic investigations of the springs and wells were made by the Bureau of Plant Industry. These were the first on record of an extended series of investigations of their kind. Dr. Kinyoun did make six such examinations in 1895, in four of which he found the water-supply to be contaminated. Previously the analysis of waters was only chemical. The revelations were start-

8. Bulls. 35, 44 and 52, Hyg. Lab. P. H. and M.-H. S.

ling. These showed that nearly one-half of the water-supplies were contaminated with fecal bacteria and that 25 per cent. of the remainder contained many more than 500 bacteria per cubic centimeter. The revelations of contamination are quite astounding in other states as they have been in the vicinity of Washington. Examinations have been made in the District of Columbia, Maryland, Virginia, Massachusetts, Illinois, Wisconsin and Minnesota. The latest report,[9] by Kellerman and Whitaker, issued Nov. 6, 1909, shows that out of 79 samples of water from as many farms in Minnesota 59 were polluted, and on 23 of these farms there was a record of typhoid fever. These studies have confirmed the contention of the danger from this and other contaminations of milk.

CONFERENCE ON MILK-SUPPLY

The investigations of the dairy farms and city depots supplying milk to Washington disclosed many alarming conditions. These were considered by the Medical Society of the District of Columbia and a number of interested citizens. I submitted the ascertained facts to Mr. Macfarland, then president of the Board of District Commissioners. Simultaneously Mr. Macfarland's attention was called to a suggestion made by Mr. E. Berliner that a conference be held on the milk-supply. This suggestion was made at a meeting held at Mr. Berliner's house, when there was a discussion of Dr. Schroeder's and Mr. Cotton's recent publication on the contamination of milk with tubercle bacilli and the significance of such contamination. Mr. Macfarland at once invited a number of gentlemen from private and official life to take part in such a conference.

It was shown that milk and dairy products were disseminators of disease. Repeated instances were cited of outbreaks of typhoid fever, scarlet fever, diphtheria and sore throat, as positively being traced to infected milk. The fearful death-rate among infants, directly from impure milk, was shown. Attention was also called to the danger of milk as a carrier of tuberculosis. Fortunately while pointing out these alarming conditions, the conference pointed out the methods for modifying the danger. The proceedings of the conference were published by the Department of Agriculture as

9. Bull. 154, Bureau Plant Industry, Dept. of Agric.

Circular 114 Bureau of Animal Industry under the title "Sanitary Milk Production." The value of the report was greatly enhanced by the fact that it was issued after careful consideration in conference by all of the contributors. It demonstrated the importance of occasionally having the cooperation of official and non-official persons. This furnishes another instance of the watchfulness of the Department of Agriculture over the public health.

The London *Lancet*,[10] in an editorial headed "Federal Text-Book on Pure Milk Questions," says of this circular:

> The Agricultural Department at Washington has issued a volume of reports containing the results of the conference of experts called together by the department to consider the various questions now agitating the country in regard to the purity of the milk-supply. The conference consisted of thirty-five recognized experts in the study of the questions involved. This volume will be the recognized text-book of the health authorities of this country for the present, as it carries the weight of authority of these experts, and the endorsement of the Department of Agriculture. In brief, these experts agreed upon a definite milk program and have recommended that public safety should be assured by legislation establishing three classes or grades of milk—namely, certified, inspected and pasteurized.

Constant instances of serious outbreaks of diseases from contaminated milk are being reported.

The occurrence of 600 cases of streptococcus sore throat in Stockholm, traced to a streptococcus abscess in the udder of a cow with other reports of similar infections has drawn attention to the necessity of immediate study of the significance of streptococci in market milk.

The rapidly accumulating reports of outbreaks of typhoid fever resulting from milk infected by bacillus carriers have excited an increased interest throughout the world in the improvement of the milk supply. Dr. Biggs, like many others, has been so impressed with the danger from this source that he considers it almost impossible to secure a safe milk-supply without careful and repeated inspection, including complete and repeated bacteriological examinations of every one connected with the production and handling of milk. As a result of his report, covering this and other points, the

10. Lancet, London, 1907, ii, No. 13.

New York City Board of Health has adopted an order requiring satisfactory pasteurization of milk used for drinking purposes.

In the fall of 1908 over fifty cases of typhoid fever in Washington, D. C., were traced to the supply of milk from a single farm. The owner was a bacillus-carrier. The supply of milk from this farm was stopped.

From the well-known prevalence of rural typhoid, the presence of bacillus-carriers, and the existence of contaminated water-supplies at many farms which can readily contaminate milk, it seems that milk is a far greater factor in keeping up the typhoid rate in Washington than a number of writers have been willing to admit. I have always contended that dairy products were the principal sources of the disease. In view of recent investigations, I reassert my position.

BOVINE TUBERCULOSIS

During the past three years extraordinary progress has been made in the study of the relation between human and bovine tuberculosis. The position of Koch that bovine tuberculosis is a negligible factor in the causation of human tuberculosis is no longer tenable.

The work of Schroeder and Cotton on this subject attracted universal attention. It was deemed to be of the greatest importance. The British Royal Commission to inquire into the relation of human and animal tuberculosis, confirmed these experiments in every particular, and so reported to the British Parliament in January, 1909, in its "Third Interim Report." Their report was based on the information obtained from these repeated experiments.

Influenced by this report the Board of Agriculture and Fisheries of Great Britain issued in May, 1909, "The Tuberculosis Order of 1909." This order provided that after Jan. 1, 1910, milk sold in Great Britain should come from tuberculin-tested cows, or should be sterilized. These two paragraphs from this order are very positive:

> As your local authority are doubtless aware, the subject of tuberculosis in man and in animals, and the relations between the disease in human beings and in animals has been under careful investigation during recent years in this country and abroad, and various phases of the question have been inquired into by successive royal commissions. So far as regards the possibility of the transmission of the disease from affected

bovine animals to man, the board are satisfied that it must now be accepted as a fact that tuberculosis is transmissible by the agency of milk used for human consumption. The Local Government Board concur in this view, and a bill was introduced in the House of Commons by the President of the Local Government Board on the 25th inst. designed, *inter alia*, to afford protection to the public health from the risk of the spread of tuberculosis by the means of milk used for human consumption.

In considering the question in relation to animals, the fact that the disease is communicable to man by milk has a material bearing on the measures to be adopted. Any action which results in the reduction in the number of tuberculous bovine animals in the country must reduce the risk of the spread of tuberculosis amongst the community, and if it were possible to eradicate from this country the disease in animals, a material step forward would have been taken in the campaign against the disease in man.

The accumulated testimony on the communicability of bovine tuberculosis to man was greatly accentuated in a paper by Dr. W. H. Park, director of the research laboratories of the Health Department of New York, which he submitted in Washington, May 3, at the meeting of the National Association for the Study and Prevention of Tuberculosis.

In this paper he showed that 22 out of 84 cases of tuberculosis of children under five years of age showed the bovine type of tubercle bacilli. Dr. W. H. Welch noted that the cases reported by Dr. Park were not selected cases.

PASTEURIZATION AND STERILIZATION

Even though the danger of contracting tuberculosis due to bovine tubercle bacilli from dairy products can be eliminated, if we can obtain milk from healthy cows, there still remains the danger of contracting tuberculosis, due to human tubercle bacilli and other diseases from contaminated milk. Milk can be made safe, however, by the proper application of heat. There are two terms applied to the results of heating milk, pasteurization and sterilization. These two terms must not be confounded; the former is a process that requires the application of a much lower degree of heat than is effective for the latter. Sterilization means the killing of all the germs that may be present in milk. Pasteurization means the destruction of the disease germs that are of more common occurrence in it, such as those of

tuberculosis, typhoid fever, diphtheria, etc. The investigation of General Sternberg, confirmed by Dr. M. J. Rosenau, especially, have shown that the common or pathogenic bacteria are unable to retain their life and virulence when they are exposed to a temperature of 60 C. or 140 F. for a period of twenty minutes, and that the value of milk as an article of food is not perceptibly affected by the designated temperature. Professor Kastle, of the University of Virginia, after extensive investigation, concluded that the designated temperature, maintained for a sufficient time to destroy the disease germs of common occurrence in milk, has no deleterious effect on its nutritive value. Thousands of children under the eyes of careful and competent observers have been reared successfully on milk so treated without the slightest signs of scurvy or rickets. Rowland G. Freeman has recently shown that such outbreaks have been traced to mixed feeding; that milk was an insignificant factor. His observations were strengthened by those of numerous observers in Europe. There boiled or sterilized milk was almost exclusively used. The temperature required for sterilization does destroy the enzymes and impair the nutritive value of milk. This emphasizes the necessity for a proper appreciation of the processes of pasteurization and sterilization.

It must be kept in mind that the advocates of pasteurization do not countenance the use of unclean or old milk; on the contrary, they insist that pasteurization should be applied, but simply as a measure of safety against the dangers from milk which no other precautions can obviate. Furthermore, pasteurization should be practiced under proper supervision, and that form of so-called pasteurization which is to some extent commercially practiced, during which milk is heated to an unnecessarily high temperature for barely a fraction of a minute, should be emphatically discountenanced. Health officers should be provided with properly equipped laboratories to keep constant check on the output of pasteurizing plants. Progressive men engaged in the distribution of milk, cream, and ice-cream employ skilled bacteriologists. There are two noted instances in Washington where this precaution has been taken. The rarity of typhoid fever amongst the customers using this pasteurized milk and ice-cream has been marked.

All milk, whether pasteurized or not, should be consumed as soon as possible after milking.

It frequently happens that properly pasteurized milk cannot be secured on the market. The observance of the following directions for the home pasteurization of milk, by L. A. Rogers of the Bureau of Animal Industry, can then be practiced:

Milk is most conveniently pasteurized in the bottles in which it is delivered. To do this use a small pail with a perforated false bottom. An inverted pie-tin with a few holes punched in it will answer the purpose. This will raise the bottles from the bottom of the pail, thus allowing a free circulation of water and preventing bumping of the bottles. Punch a hole through the cap of one of the bottles and insert a thermometer. The ordinary floating type of thermometer is likely to be inaccurate, and if possible a good thermometer with the scale etched on the glass should be used. Set the bottles of milk in the pail and fill the pail with water nearly to the level of the milk. Put the pail on the stove or over a gas flame and heat it until the thermometer in the milk shows not less than 150 nor more than 155 F. The bottles should then be removed from the water and allowed to stand from twenty to thirty minutes. The temperature will fall slowly, but may be held more uniformly by covering the bottles with a towel. The punctured cap should be replaced with a new one, or the bottle should be covered with an inverted cup.

After the milk has been held as directed it should be cooled as quickly and as much as possible by setting in water. To avoid danger of breaking the bottle by too sudden change of temperature, this water should be warm at first. Replace the warm water slowly with cold water. After cooling, milk should in all cases be held at the lowest available temperature.

This method may be employed to retard the souring of milk or cream for ordinary uses. It should be remembered, however, that pasteurization does not destroy all bacteria in milk, and after pasteurization it should be kept cold and used as soon as possible. Cream does not rise as rapidly or separate as completely in pasteurized milk as in raw milk.[11]

CONCLUSION

If the lessons taught by these observations be heeded, a great step will be made toward the control of milk-borne infections. Dollars spent by the thousand for prevention will save millions needed for the care of those afflicted with disease, to say nothing of the days of suffering that will be avoided.

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11. Circ. 152, Bureau Animal Industry, Dept. of Agric.

It can no longer be doubted that dairy products—and this term includes milk, cream, ice-cream, butter and cheese—are excellent vehicles for the dissemination of pathogenic bacteria. Outbreaks of typhoid fever, scarlet fever, diphtheria, sore throat, and intestinal disorders of children have been definitely traced to contaminated milk. The proofs of the danger of tuberculous infection from these products are accumulating daily. The opportunities for such infection are manifold. With the greatest vigilance on the part of trained inspectors and the greatest care on the part of the householder this infection cannot be entirely prevented. The householder also has a duty to perform to protect milk from contamination after it has been delivered.

Of course the carrying out of the recommendations for the production and delivery of more sanitary milk entails additional expense at the farm and the city depot. But the receipt of a single additional cent for a quart of milk would justify many improvements by the producer and the seller. A single case of sickness or a funeral resulting from contaminated milk would cost far more than the slight additional price of better milk for a long period.

Under these circumstances there should be no question about demanding that milk should be produced under conditions that would entitle it to be entered under Class 1 (certified milk) or Class 2 (inspected milk) as prescribed by the Washington Milk Conference; or, in case it does not conform to the requirements for these classes, that it should be efficiently pasteurized (Class 3). This classification, prepared by Dr. A. D. Melvin, Chief of the Bureau of Animal Industry, and approved by the Washington Milk Conference, is more fully described in Circular 114 of the Bureau of Animal Industry already referred to. It is a classification that will give us, not bad, indifferent and good milk, but good, better and best milk. To produce milk under any of these classes rigid inspection is required.

The prices that must be charged for the first class make it almost impossible for the man of moderate means to avail himself of such milk. Class 2 can be produced at a lower price, but would still cost more than ordinary milk. Hence the masses must resort to the milk of Class 3. With the precautions suggested, they would reasonably be assured in the use of this milk of a safe and

wholesome supply at but a trifling advance in the price.

Those who are interested in the improvement of the milk supply and who wish to obtain a comprehensive summary of facts bearing thereon, are advised to write to the Secretary of Agriculture at Washington, D. C., for a copy of Circular 153 Bureau of Animal Industry, issued April 28, 1910. The title of the circular is "The Dissemination of Disease by Dairy Products and Method of Prevention."

Stoneleigh Court.

ABSTRACT OF DISCUSSION

Dr. William C. Woodward, Washington, D. C.: After searching for a proper basis on which to determine whether or not we have achieved any substantial results through our milk inspection service, I selected deaths from diarrheal diseases only, among children under 2 years of age, and it is to those alone that the chart exhibited by Dr. Magruder relates. It is true, as Dr. Magruder says, that the method of milk inspection in use in the District of Columbia was original with a committee of the medical society of the district, on which committee I had the honor to serve. Working quite independently of anything that had been done previously, so far as we then knew, we devised it. Later, however, it came to my attention that as far back as 1873, the three food inspectors who were then doing duty in the District of Columbia had united in a formal report to the then board of health recommending this very method of inspection. This proposed method included not merely the inspection of the farms by the inspectors in the service of the then existing board of health, but included also the permit system, whereby one city or one state can control the situation outside of its territorial jurisdiction. Later, about 1884, one of my predecessors actually inspected some of the dairy farms supplying milk to the district. I mention these things so that honor may go where honor is due. Had these early workers had back of them such public sentiment as was created by the publication of the admirable report of Dr. Magruder's committee, that first pointed out the probable sources of typhoid fever in the District of Columbia, their work would doubtless have continued. As it was it died utterly, even its memory having passed from the public mind.

Dr. William H. Welch, Baltimore: I think that a model demonstration exhibited in the national capital is significant and impressive, and likely to be productive of results to the rest of the country. Of course, we all realize, I think, that sanitary problems connected with milk are about the most urgent and perplexing, in many ways, of solution, of any. Some years ago in Baltimore we had made an endeavor, at

least, to start the same sort of a campaign of education of the public regarding milk that we had attempted in regard to tuberculosis. It may not be known to all that the first tuberculosis exhibit was that arranged by Dr. Fulton in Baltimore. It was a great success there, far beyond any thing we dreamed of; and since then it was adopted elsewhere; but give him credit for that. We have attempted to do the same thing for milk, but it has not had the same response; but I think it is a good idea, and that possibly the time is now more suitable.

It may be that the large mortality in the hospitals is due to the poor quality of the milk used there; but there is a question whether the high mortality of those particular hospitals is due to the milk.

Dr. B. Franklin Royer, Harrisburg, Pa.: Members of this Section might be interested in the educational campaign undertaken by the Department of Health in Pennsylvania. Three years ago our health officers, the men who institute quarantine for us, placard and disinfect premises, etc., were trained for dairy inspection by placing suitable literature in their hands and by having them further instructed by the county medical inspector under whom they work.

At the present time all dairy farms in the commonwealth are inspected twice each year. In our winter inspection completed some time in March we reached a total of 55,000 farms and stables producing milk for sale to creameries, condenseries, cheese factories, wholesalers, retailers and for sale from individual dairies. The inspection up to the present time has not, of course, been done with the great detail practiced at Washington, and it in no way interferes with towns and cities that have already some system of inspection of their own. In fact, it is a campaign intended to reach the men who are handling the cows and stables and caring for the milk in the country. After the inspection is made circulars are handed these men describing conditions that should exist, emphasizing particularly the need for cleanliness of cows' flanks and udders, the need for excluding all forms of dirt from the milk and the importance of cooling it at once.

We are now sending letters to each producer calling attention to the insanitary conditions found. This work reaches far back into the country district where the initial infection of milk commonly begins.

We have a statute which makes communicable diseases reportable, typhoid included. On receipt of such report telling us of the existence of typhoid, diphtheria or scarlet fever on a premises from which milk is sold, our county medical inspector at once visits the premises and establishes the department's regulations for the control of the milk-supply. If such regulations cannot be established, the sale of milk is stopped or the stock is transferred to a neighboring farm.

Dr. William Edward Grant, Louisville, Ky.: As has been suggested, we look up to Washington; what governmental au-

thorities order and advise has great influence throughout the entire country. I am acting as health officer for my city, and we are much interested in what Washington tells us. Through such influence, in part, we have been able to get every cow that produces milk for the city I live in tuberculin-tested. We had a hard fight to accomplish this and it took six to eight months of very earnest and constant endeavor. The health officers of the state first issued an order that no milk should be sold in our state that did not come from tuberculin-tested cows; and then the city health officer wrote a letter to each dairyman who sold milk in Louisville, telling him that after a certain date no milk would be permitted to be sold in our city that did not come from a tuberculin-tested cow.

At the same time an order was given that no new cows should be brought into the herd, unless they were tuberculin-tested, and that the dairymen should clean up their dairies and disinfect them according to methods suggested by the government at Washington. In that way we have improved the milk-supply wonderfully in our city; and have also interested our dairymen in keeping it improved. The education to them has been of great value. The fact is, I believe, the dairymen usually are glad to improve bad conditions, if we tell them how. They didn't know how; and they welcomed somebody who would come and say "This is wrong; and this is the way to correct it." Now we have dairy inspectors go to these dairies and see that the cows are properly curried, and the udders properly washed before they are milked, and the milk taken to a separate place and cooled; and we try to persuade our dairymen to bottle it at once and bring it to market in that way.

I think that bovine tuberculosis is very dangerous to children, but not dangerous to adults. The children in the hot weather are a good deal run down, no doubt, by the heat; and the germicidal power of the blood being lower, the germs find easy access and a location in the alimentary canal of infants, and in that way they become diseased. That is avoided in part by having none but pure milk distributed. "The Babies' Pure Milk Fund" is doing a good work with us, and we have also pasteurized and certified milk, and in this way see that the babies get only the best.

Dr. Seneca Egbert, Philadelphia: A few years ago, when the newspapers of New York were advocates almost universally of pasteurization of the milk, if I remember rightly, Dr. Darlington, of the board of health, opposed pasteurization at the dairy, the objection being that it gave the consumers a false sense of security, since a considerable period elapsed from the time the milk left the dairy until it reached the consumer, and there was the possibility that in the time of transit the milk might be contaminated, especially if carelessly handled. It does seem to me that that objection can be made a very

strong one—that the milk can be pasteurized, and yet, if the way be left open for careless handling on the part of the train men or the dairy dealers in the cities, that there is chance for danger there.

Another thing that I am glad Dr. Magruder mentioned was the fairness of giving the dairymen and milkmen—the producers—a higher price for the milk. It is unfair, it seems to me, for us to advocate this better milk, unless we are willing to pay for it. Any man who knows anything about farming, knows that it is a pretty hard thing to provide the things demanded—sanitary barns, good stock and all that—and then to get no more than 3 cents or thereabouts for the milk. We must educate the public to allow a higher price for the milk—see that they understand that that don't come into the category of things to be cheapened in the attempt to reduce the high cost of living. The question of inspection is the big question and I believe that we have yet to appreciate that in most of our large cities the cost of inspection is apparently prohibitive. It ought not to be, but we are not getting—at least, as far as the municipalities are concerned—as much inspecting nor as many efficient inspectors as we should have.

Dr. G. Lloyd Magruder, Washington, D. C.: First in regard to Dr. Woodward's observation, I do not claim paternity of the idea of the inspection and permit system. I did claim and do claim that the report of the committee of 1894, embracing recommendation 9, quoted by me, directly caused the passage by Congress of the law giving this authority to Washington. Hence I think it is justifiable to claim the honor of being instrumental in the initiation of inspection.

As to Dr. Welch's observation, I said bad milk was *probably* the cause of the high death rate in hospitals. The lowest rate occurred where little milk was used. It is a great satisfaction that Dr. Welch has corroborated the statement that bovine tuberculosis causes from fifteen to twenty-five per cent. of certain cases of tuberculosis in children under five years of age.

In answer to Dr. Egbert's question, pasteurization should take place in the city under official supervision. I spoke of 50° F. as the danger line because of the rapid growth of bacteria in milk above this temperature. This prompts me to mention the desirability of investigating the effects of freezing milk. I shall promptly take up this question with the Secretary of Agriculture. Three years ago the United States Consul at Chemnitz reported to the State Department that a German physician had recommended the transportation of milk in frozen blocks, since no deleterious influence was exerted by freezing. American officials caution against allowing milk to freeze. These divergent views interested me at that time. I sought without success to have them investigated at the Hygienic Laboratory. General Sternberg, chairman of one of the committees at the Yorktown Exposition, awarded first premium for milk to the Virginia Polytechnic School at Blacks-

burg. This milk was delivered partially frozen, after transportation 400 miles in jacketed cans.

The influence of this Section since 1907 on the milk problem has been so great that I thought it desirable to report what has been done in Washington. The symposium at Atlantic City in 1907 on the milk supplies of several cities received marked attention. The paper which I read at the symposium contained observations made by officials of the Bureau of Public Health and Marine-Hospital Service, of the Department of Agriculture, of the Health Officer of Washington, and of citizens in private life. Much enthusiasm was manifested at the information, which showed that the government authorities were so interested in milk and water supplies.

I had seen Mr. Loeb, Secretary to President Roosevelt, before I left Washington. Mr. Loeb stated that the President was opposed to a department of public health, but was heartily in favor of a bureau. On my return to Washington I saw President Roosevelt and reported the proceedings of the Association on public health matters. He showed marked interest. He directed the investigation of the milk supply as requested in the letter introduced in my paper. Many other valuable investigations along this line have been conducted since then by the government. Much of this interest is directly due to the impetus given to the movement in this section in 1907.

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